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Size Effect Still Present in the Athens Stock Exchange

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Abstract

This study aims to shed some light on the academic debate about the validity of CAPM and whether systematic risk is the only factor that is priced in the markets.

The fact that other factors have proved to offer return premiums in the capital markets is presented in the finance literature as anomaly. The firm size has been shown by a plethora of studies to be negatively related with returns, a phenomenon that is called small firm effect.

However, recent empirical studies have claimed that the small firm effect has come to an end globally in the late 1980s. This paper comes to fill that gap and examine whether the presented size effect in the Athens Stock Exchange for the 1970s and early 1980s has still been strong in the recent years.

The results show that size is negatively related to returns in the period 1990-2001 and in all of the specific market conditions studied, with various beta estimates being incapable of explaining the risk – return relationship even when thin trading is taking into account. Standard deviation as a measure of total risk proves to explain partially the constant superior returns of small firms since it is implied that these returns could be a compensation for the higher volatility involved.

1. Introduction

After the introduction of the CAPM by Sharpe (1964) and Litner (1965), its validity has remained one of the most controversial areas in the finance literature. Since the systematic risk was first assumed to be the only factor that affects the returns of assets, the investors should use beta as the most accurate measure of this risk.

However, there is a plethora of studies, which suggest that beta has proved to be incapable of explaining sufficiently the risk return relationship in several capital markets. Fama and French (1992) have shown that beta could not explain the returns of a large number of stocks listed on the AMEX, NYSE and Nasdaq from 1963 to 1990. Fama and French (1996) lead to the same conclusion regarding the inadequacy of the beta factor to explain expected returns.

Timmermann (1996) shows that the same happens for UK stock returns. Crombez and Vennet (1997) provide supportive evidence for the CAPM theory since they suggest that betas can predict efficiently the risk/return relationship in both bull and bear periods of Brussels Stock Exchange during 1990-96.

A predominant role in the contestation of CAPM as a valid theory is the fact that the firm size seems to be a significant variable in explaining expected equity returns. Banz (1981) provides evidence that small firms as measured by the value of market equity, yield much higher returns than large firms after adjusting for risk. Ibbotson and Brinson (1987) using Banz' data for the period 1926-80, found that the smallest firms produced 3.2% higher geometric annual returns than the largest companies. Glezakos (1994) analyzes the firm size and return relationship for the Athens Stock

Exchange and provides evidence about the negative relation between firm size and stock returns.

Reinganum (1992) leads to the same conclusion after calculating average annual returns for NYSE stocks for a very long period (1926-89). Bauman et al (1998) show that there is a strong small size effect for a large number of stocks, which are included on the indices of MSCI for Europe, Australasia, Far East and Canada.

Levedakis, Davidson and Karathanassis (2001) also show that firm size has had significant explanatory power on the Athens Stock Exchange in the recent years. Dissnaike (2002) finds a size effect within the firms of FT500 in UK although this has not proved to be very strong.

Nevertheless, there is no unanimity in the findings of the finance literature since there are a number of studies, which contradict the findings that small firms yield constantly higher returns. What is worthy of further research is the fact that there are currently an increasing number of studies, which claim that the small size effect has ceased to exist in the late 1980s.

In a study by Ibbotson Associates (1992), it is documented clearly that the performance of small firms has diminished considerably over the last decades. By comparing the performance of S&P 500 and the performance of a large number of small firms from 1926 through 1991, it is obvious that small firms yielded superior returns from 1926 to 1980 and lower returns than large firms in the last researched period 1981-91.

Siegel (1994) also argues that the superior performance of small-cap stocks in the US markets from 1926 to 1996 can be attributed only to the period from 1975-1983. Efakhani and Zaher (1998) research the performance of all the firms trading on the AMEX and NYSE from 1986-1990 and extract the conclusion that there is no small size effect. Horowitz, Loughran and Savin (1998) also confirm the underperformance of small cap stocks by presenting that during the period 1980-96 the smallest firms in AMEX, NYSE and Nasdaq yielded an average monthly return of 1.33 percent versus 1.34 percent by the largest firms.

Speidell and Graves (1998) and Levis and Steliaros (1999) also report an average underperformance of small firms across developed European and emerging markets in the recent years. Levis (2000) also advocates that there is a clear reversal in the preceding trend of the superior performance of small-cap stocks in UK and other major equity markets worldwide. Comparing Hoare Govett Smaller Companies Index (HGSC) to the FTSE All Share for the period 1955-88, it is documented that there has been a dramatic reversal of small companies' performance in the recent years.

The target of this study is to shed light on whether there is still a small size effect on the Athens Stock Exchange or has ended in the recent years following the same pattern of other European stock exchanges, which was documented in the studies mentioned above. Compared to previous research that have investigated the firm size effect in the Athens Stock Exchange, this study covers the very recent years including 2001, a fact that is very important since the last few years are considered to be crucial given that the Greek economy experienced tremendous structural changes and advances, which finally led to the introduction of euro in 2002. At the same time, the Athens Stock Exchange was upgraded to a developed capital market. In spite of the above improvements, the Athens General Index experienced a sharp decline after an impressive bull period, a fact that increases further the interest in investigating this period.

2. Data

The sample includes all firms currently trading on the Athens Stock Exchange (ASE) for the period 1st January 1990 to 31st December 2001. Data on shares outstanding, prices, returns and Athens General Index returns are obtained from the database of Effect SA. The firms included in the sample range from 58 in 1990 to 230 in 2001.

3. Methodology

At the outset of each year, the shares in the sample are ranked in ascending order according to their Market Capitalization Value. The MCV is calculated by multiplying the total shares outstanding on the last day of the previous year by the unadjusted price of that day. In case the firms have more than one type of shares, all the other types are added to the common shares to form the total shares outstanding.

Having ranked all shares in ascending order based on their market values, five portfolios are formed equally with portfolios MV1 and MV5 being the ones with the smallest and largest firms respectively. Monthly-adjusted returns with reinvestments of dividends are used for each share. The average monthly return of each portfolio is the raw average of the monthly returns of the shares that constitutes the portfolio. This process implies monthly rebalancing to equal weights.

For the calculation of the perceived risk associated with each portfolio, the series of portfolio monthly returns are regressed against the monthly returns of the Athens General Index, obtaining the OLS beta estimates. The Athens General Index is a price index, includes the sixty largest companies and it is the only market index available that has existed for the whole time period.

The estimation of betas is obtained using the market model:

$R_i = \alpha_i + \beta_i * R_m + \varepsilon_i$,

where R_i is the return on i-th portfolio with reinvestment of dividends, β_i measures the systematic risk, R_m is the returns of the market index and ε_i is the error term.

Betas are calculated in two different ways with the view to capturing the active process of risk perception by investors in equity markets. First, the 24 monthly returns prior to the formation of each portfolio are used for the estimation of betas over rolling time windows. The same methodology is adopted in the studies of Grombez and Vennet (1997), Davis and Desai (1998) and Grundy and Malkiel (1996). Furthermore, the latter study provides evidence that there is little difference in the results when betas are calculated using 24 and 60 months of prior returns.

However, this methodology implies inevitably that the investment selection for the whole year t is only affected by the perceived risk, which was created solely by the historical volatility of the specific shares during the previous two years t-1 and t-2. However, the perception of risk and the way that affects the trading behaviour is a dynamic process, which means that the perception of risk is not formed only based on past volatility of the asset. On the contrary,

the perception of risk is being readjusted constantly during the same year that is used to calculate returns. This is due to the fact that the incessant flow of information to the market affects constantly the perception of the investor regarding the risk associated with each asset.

With the view to achieving more realistic estimates, we also measure betas in a second way in which the time window of the 24 months covers the twelve monthly returns prior to the formation of portfolio (year t-1) and the twelve monthly returns of the holding period (year t). The usual statistical criteria (R^2, F-test, t-test) are used to assess the reliability of the extracted results.

However, in order to derive reliable conclusions, it is inevitable to take into account thin trading, given that very low volumes have characterized the Athens Stock Exchange in almost all of the years under examination. Assuming that liquidity problems may be stronger in smaller firms, we can conclude that the violation of CAPM may be just due to the effect of thin trading. This assumption is also consistent with the findings of Fisher (1966) and Dimson (1979), who have argued that thinly traded shares are biased downwards while frequent traded shares are biased upwards.

For the above reasons, portfolio betas were calculated through the application of Dimson's Aggregated Coefficients Method (AC) of Dimson, using the following equation:

$R_{it} = a_i + \sum_{k=-m}^{n} \beta_k R_{m,t\pm k} + \varepsilon_t$, where k is the order of lag and n is the order of lead values of R_{mt}

The AC beta coefficient was defined as the sum of the partial Dimson's beta coefficients: $b_D = \sum_{k=-m}^{n} b_k$

In addition, the standard deviation of the monthly returns for each portfolio is calculated on an annual basis so as to have a second measure of risk and to examine whether standard deviation as a measure of total risk has more explanatory power than beta estimates, regarding the risk-return relationship.

Gooding (1978) shows that US institutional investors include apart from beta, standard deviation of returns to form their perception of risk. Ibbotson Associates (1992) and Efakahani and Zaher (1998) also use standard deviation of returns as a measure of risk when researching the small firm size effect.

Having examined the phenomenon of small firm effect over the whole period 1990-2001, this study goes further to research whether the conclu-

sions could be different if we isolate different market conditions in the sample. For this reason, we classify three time periods that correspond to a flat, bear and bull market of the Athens Stock Exchange. Bull, Bear and Flat markets are identified arbitrarily using monthly observations of Athens General Index since the periods selected are the most representative for these periods in the contemporary history of the Athens Stock Exchange. The corresponding periods for the three different market conditions are for the: Flat market 1/4/94-31/12/96, Bear market 1/12/99-30/9/2001 and Bull market 1/10/98-30/11/99. The same methodology that is explained above is also applied to the study of the small firm size phenomenon in these different market conditions.

4. Empirical results and interpretation

4.1 Returns

The returns of five portfolios show a remarkable outperformance of small firms during the researched period (Table 1). More particularly, in nine out of twelve years the small firms yielded higher returns. However, the negative relationship between size and return is linear only in two years.

The smallest firm portfolio (MV1) produced on average twice the return than of the large firm portfolio (MV5) except for 1990, 1997 and 2000, when smallest firms underperformed the largest ones, a fact that can be explained as follows:

- In 1997, the Greek economy entered a period of sustainable recovery after long downward phase. The GNP started to advance at a very high pace while inflation was considerable reduced. The combined effect of these improvements led analysts to the conclusion that Greece might fulfill the criteria to become the 12^{th} member of the Euro Zone. As a result, many institutional investors invested into the Athens Stock Exchange selecting mainly blue chips (large firms), which offered the necessary liquidity.
- After a mean return of 400% that the smallest firms had earned in 1999 their losses were obviously higher than the ones of largest firms in 2000 when the Athens Stock Exchange entered a downward phase.

The results of the portfolios during bull, bear and flat market conditions are presented in Table 2. During the bull period, the smallest size portfolio MV1 yielded an impressive annualised return of 395%, which is more than triple the one of largest size portfolio MV5. The striking performance of small-cap stocks may be strongly associated with an incredible increase of the individual investors during the same period. According to the figures released by the Athens Stock Exchange (ASE 2001), the total number of active individual investors in 1999 reached the incredible number of 1.5 million.

In the strong Bear period that came just after the bull period examined in this study, the smallest firms (MV1) suffered higher losses than the largest firms (MV5). However the extent of the differences in performance is not so great to compensate for the tremendous superior performance of the small-cap stocks during the preceding bull period.

In Flat period, the smallest firm portfolio managed to yield a slight higher return, a fact that adds one more evident towards the constant existence of a small firm size phenomenon on the Athens Stock Exchange.

4.2 The conditional risk-return relationship

The results of the estimation of betas with a 24-month time horizon prior to the formation of each portfolio are presented in table 3 and show that small-cap firms managed to yield a higher return with a much lower risk, as it is measured by betas. The average beta for all the years of the smallest size portfolio MV1 is just 0.73 with the beta of the portfolio MV5 being 0.91. From the average betas of the whole period, it is obvious that the relationship between firm size and beta is negative and linear

This constitutes a strong violation of CAPM since the superior returns of smallest-cap stocks cannot be explained as a compensation for a higher risk. During the whole period, in only four years were the smallest stocks riskier than the largest ones. In addition, the results raise questions regarding the reliability of beta as an efficient measure of systematic risk.

The results were statistically significant at the 1% level of confidence while the same time the fit of the regressions was satisfactory with R^2 ranging from 46% for portfolio MV1 to 87% for portfolio MV5. Nevertheless, in the case of the portfolio with the smallest firms (MV1) the fit of the regression is very small in a number of years, a fact that reduces the reliability of the results. The high values of F-tests together with the very low p-values also reveal the strong significance of the overall regressions.

The beta estimates for the three market types (flat, bear, bull) as presented in Table 4, show that the large-cap shares were much riskier in every market condition. The fact that the relationship between beta estimates and returns is negative is obviously a sign that beta cannot measures the systematic risk effectively. However, this is may be due to problems in the data used to calculate betas. The Athens Stock Exchange suffers from liquidity problems in many years, which are more intense in small-cap stocks. Thus, there may be a marketability bias in the calculation of betas, which leads to very small estimates like the ones in the years 1992 and 1998 when betas are excessively small (0.27 and 0.3 respectively) with the fit of the regression also being very small.

The estimation of betas in the second way, in which the holding period is included in the regression, does not produce considerably different results (Table 5). The portfolio MV5 is still riskier than portfolio MV1 and there is a negative relationship between size and beta. However, the results are not statistically significant for portfolio MV1 in years 1991, 1994 and 1999. The fit of the regression as measured by R^2 is on average small for portfolio MV1 and satisfactory for the other four portfolios. The F-test has in general high values with p-values being close to zero.

As a next step, Dimson's methodology was applied to examine whether thin trading is responsible for the above results. More particularly, after a "trial and error" procedure, it was found that best results were obtained through the use of three lag values of the independent variable, in addition to its contemporaneous value. The results stated in Table 6 reveal that the strength of inverse risk-return relationship measured by AC betas, is diminished since the beta estimates of the smaller portfolios (MV1) increase in most of the cases much more in percentage terms than the betas of larger portfolios (MV5). Nevertheless, the overall results of AC betas do not affect in almost all of the cases, the conclusions regarding the existence of small firm effect and the inverse risk-return relationship. This implies that either Dimson's methodology is not capable of capturing the effect of thin trading or there is no thin trading in such an extent to justify the violation of CAPM.

Having raised serious doubts about the ability of betas to measure market risk effectively, we use standard deviation as an indicator of the total risk in order to assess whether the negative risk-return relationship is only due to the fact that it reflects inherent problems in beta as a risk measurement tool. The calculation of standard deviation of returns for each portfolio produces valuable results for the extraction of a definite conclusion. As it is presented in Table 7, the average standard deviation for MV1 for the whole period is higher than the one for portfolio MV5, which shows that small-cap stocks may be riskier than the large cap stocks. Therefore, the superior performance of portfolio MV1 may be just a compensation for its higher volatility, which in financial markets is a synonym for risk.

The results are even more striking when we examine the different market conditions (Table 8) since small firms are proved to be riskier in all markets and the average size-risk relationship is negative and linear. The risk-return relationship is positive in bear, bull and flat market conditions which provides evidence that standard deviation is a much better risk indicator than beta.

4.3 Corresponding findings of similar studies

The existence of a strong small size effect is obvious on the Athens Stock Exchange in the last years, which cover one of the most important periods in the history of both the Greek capital market and economy. The findings of this study together with the conclusions drawn by previous studies i.e. Glezakos (1994), show that the size effect of the previous decades has not ceased to exist during recent years. This is in contrast with the findings of a plethora of recent studies such as the ones by Speidel and Graves (1998), Brooks (1999), Levis and Steliaros (1999) and Levis (2000), which provide evidence that small size effect has ceased to exist in the late 1980s on a global basis.

The choice of market index, which in the case of the Athens Stock Exchange includes currently only the sixty largest firms, may affect the quality of the estimates. This may explain the tendency of betas of large firms with a higher weight in the Athens General Index to be close to one.

The failure of betas to explain the higher returns and lower risk of small-cap firms is consistent with a lot of studies in the past and contemporary literature (see Corhay et al (1987), Fama and French (1992), Crombez and Vennet (1997)). However this finding must be tackled with cautiousness since it may be due to problems in the methodology adopted and data problems. For example, even though monthly returns are used by the majority of the studies, Handa, Kothari and Wasely (1989) and Kothari, Shanken and Sloan (1995) claim that using annual rather than monthly returns produces a much stronger positive relation between average return and beta. Furthermore, even though a survivorship bias exists in the data, it is highly unlikely to affect the quality of results significantly.

A plethora of studies argue that even the broad market indices are not good proxies of the market risk and thus any documented failure of betas to explain returns does not constitute evidence for the invalidity of the CAPM theory. Mayers (1972), Roll (1977 and 1978), Jagannathan and Wang (1993) argue that a valid proxy for the systematic risk should include assets like bonds, property and even human capital.

Thin trading that is more apparent in small firms is one more factor that may affect the estimation of betas. This problem could be overcome with the adoption of a methodology such as Dimson models (1979). The finance literature is very rich in studies that examine the effect of thin trading on the estimation of betas. For example, Fisher(1966), Dimson (1979) and Fowler, Rorke and Jog (1979) document that beta estimators are downward biased in thin markets. Glezakos (1994) uses Dimson's methodology and finds that small firms proved to be riskier using Dimson methodology than OLS estimates.

The higher volatility in returns of small-cap stocks as measured by standard deviation is consistent with Elfakhani and Zaher (1998) and Levis (2000) who show that small firms have higher total risk (standard deviation). Therefore, the higher return of the small cap stock may be partially due to the fact that investors demand higher return as compensation for the higher volatility.

The underperformance of small firms during some periods has been explained by a number of academics as evidence for cyclicality of the size effect. Levis (1985) documents significant variations in the performance of small size firms during the sixties and seventies. Levis and Kallionzi (1993) show that there is cyclicality in the performance of small firms in the UK during the period 1960-1991. However, the cycles are characterised by an irregular length, which makes forecasting extremely difficult. Reinganum (1992) also shows that there is a five-year cycle in the outperformance of small firms in the NYSE during 1926-1989. Bernstein (1995) provides evidence that there is variability in the returns yielded by small firms and as Levis (2000) documents, it appears that there is a reversal in the size effect over sustained periods.

The small-size effect can be attributed to a lot of factors. First, it is claimed by a number of studies that the outliers in the data can be strong enough to create a distorted picture of the results. Knez and Ready (1997) show that the results of Fama and French (1992) were not robust without the outliers in the data. Another explanation is that small company effect is closely related to neglect. Small companies are most of the times neglected by the analysts and thus they should compensate investors for the lack of information regarding their financial condition. The relationship between small firms and neglect is documented by studies such as Amihud and Medelson (1984 and 1991), Carvel and Strebel (1987), Efakahani and Zaher (1998), Lofthouse (1993,p.109).

Furthermore, some studies claim that is more a joint January and size effect since most of the abnormal returns occur in January (see Keim (1983), Rogalski and Tinic (1986), Rathinasamy and Matripragada (1996)). The superior return of small firms is also explained as compensation for the higher transaction costs associated with thrading of small-cap stocks (see Stoll and Whaley (1983) and Loeb (1991))

Table 1
Average Percentage Monthly Returns for portfolios based on firm size

Firm Size	Portfolio	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Average
Small	**MV1**	6,52	-0,11	2,84	6,18	3,43	2,69	0,79	1,92	7,72	33,32	-8,26	-0,03	**4,75**
	MV2	6,76	-1,65	-1,31	6,72	0,69	1,23	-1,40	2,24	4,72	25,95	-7,33	-0,31	**3,02**
	MV3	6,77	-0,56	-1,99	4,91	-0,32	-0,29	-1,43	1,27	7,71	18,69	-8,14	-0,26	**2,20**
	MV4	8,56	0,43	-0,67	3,97	-0,34	0,71	-0,18	3,50	5,95	15,32	-6,92	-1,53	**2,40**
Large	**MV5**	8,20	-0,47	-0,39	3,43	-0,64	1,62	0,07	4,44	7,04	9,27	-5,17	-1,28	**2,18**

Table 2
Average percentage monthly returns for Bear, Flat and Bull markets

Firm Size	Portfolio	BEAR	FLAT	BULL	AVERAGE
Small	**MV1**	-6,15	0,75	32,90	**9,17**
	MV2	-6,18	-0,44	24,81	**6,06**
	MV3	-7,27	-0,47	18,80	**3,68**
	MV4	-6,18	-0,06	15,97	**3,24**
Large	**MV5**	-5,50	0,47	9,76	**1,57**

Table 3
Average Beta estimates based on monthly returns against the Athens General Index using the twelve monthly returns prior to the formation of each portfolio at the outset of each year

Portfolio		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Average
MV1	**Beta**	**1,3**	**0,53**	**0,27**	**0,43**	**0,49**	**0,9**	**0,91**	**0,66**	**0,3**	**0,32**	**0,56**	**2,13**	**0,73**
	t-stat *	8,82	4,86	2,5	5,34	4,01	5,16	4,99	6,16	3,29	5	2,01	5,08	4,77
	R-sqr (Adj)	77,0%	49,5%	18,5%	54,4%	39,5%	52,7%	51,0%	61,7%	30,0%	51,0%	11,7%	51,9%	45,7%
	F-test	77,79	23,58	6,23	28,48	16,04	26,62	24,94	37,99	10,85	24,96	4,05	25,78	25,61
	p-value	0,000	0,000	0,021	0,000	0,001	0,000	0,000	0,000	0,003	0,000	0,057	0,000	0,007
MV2	**Beta**	**0,6**	**0,56**	**0,6**	**0,46**	**0,75**	**1,04**	**0,85**	**0,89**	**0,46**	**0,37**	**0,64**	**2,05**	**0,77**
	t-stat *	3,16	4,69	8,75	4,46	6,56	6,72	5,2	3,62	4,48	5,12	2,56	5,86	5,10
	R-sqr (Adj)	28,1%	47,7%	76,7%	45,1%	64,7%	65,7%	53,1%	34,4%	45,3%	52,3%	19,4%	59,2%	49,3%
	F-test	9,97	21,96	76,53	19,93	43,07	45,11	27,01	13,09	20,04	29,26	6,54	34,33	28,90
	p-value	0,005	0,000	0,000	0,000	0,000	0,000	0,000	0,002	0,000	0,000	0,018	0,000	0,002
MV3	**Beta**	**0,51**	**0,65**	**0,69**	**0,69**	**0,82**	**1,05**	**1,07**	**0,97**	**0,56**	**0,47**	**0,64**	**1,81**	**0,83**
	t-stat *	3,46	9,58	11,67	10,99	6,61	5,42	6,74	5,65	4,93	4,47	2,75	6,31	6,55
	R-sqr (Adj)	32,3%	79,8%	85,5%	83,9%	65,0%	55,2%	65,9%	57,4%	50,0%	45,2%	22,3%	62,8%	58,8%
	F-test	11,97	91,75	136,25	120,89	43,71	29,35	45,38	31,94	24,33	19,96	7,59	39,77	50,24
	p-value	0,002	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,012	0,000	0,001
MV4	**Beta**	**0,76**	**0,86**	**0,86**	**0,73**	**0,89**	**1,01**	**0,87**	**0,92**	**0,75**	**0,56**	**0,67**	**1,55**	**0,87**
	t-stat *	8,4	13,43	18,47	11,6	7,22	11,25	6,49	6,73	8,35	5,69	3,17	7,1	8,99

	R-sqr (Adj)	75,1%	88,6%	93,7%	85,3%	69,0%	84,5%	64,1%	65,8%	74,9%	57,7%	28,3%	68,2%	71,3%
	F-test	70,55	180,48	341,3	134,54	52,19	126,64	42,15	45,25	69,77	32,33	10,07	50,36	96,30
	p-value	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,004	0,000	0,000
MV5	**Beta**	**1,03**	**0,94**	**0,86**	**0,81**	**0,91**	**0,76**	**0,82**	**0,91**	**0,85**	**0,86**	**0,96**	**1,2**	**0,91**
	t-stat *	15,76	22,81	22,29	18,61	12,98	10,35	5,9	15,38	14,12	19,46	9,25	10,23	14,76
	R-sqr (Adj)	91,5%	95,8%	95,6%	93,8%	87,9%	82,2%	59,6%	91,1%	89,6%	92,1%	78,6%	81,8%	86,6%
	F-test	248,27	520,37	496,86	346,49	168,5	107,21	34,87	236,6	199,47	270,9	85,63	104,66	234,99
	p-value	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

* at 5% level of significance with critical value 2,069

Table 4
Beta estimates for Flat, Bear and Bull market periods

Portfolio		FLAT	BEAR	BULL
MV1	**Beta**	**0,68**	**0,51**	**0,27**
	t-stat *	4,38	1,89	3,62
	R-sqr (Adj)	44,2%	10,1%	34,5%
	F-test	19,18	3,58	13,1
	p-value	0,000	0,072	0,002
MV2	**Beta**	**0,85**	**0,55**	**0,39**
	t-stat *	5,74	2,49	5,66

	R-sqr (Adj)	58,1%	18,4%	57,5%
	F-test	32,92	6,18	32,07
	p-value	0,000	0,021	0,000
MV3	**Beta**	**0,91**	**0,65**	**0,42**
	t-stat *	6,08	2,73	4,12
	R-sqr (Adj)	61,0%	21,8%	41,0%
	F-test	36,93	7,43	17,01
	p-value	0,000	0,012	0,000
MV4	**Beta**	**0,92**	**0,65**	**0,62**
	t-stat *	7,65	3,24	7
	R-sqr (Adj)	71,4%	29,3%	67,6%
	F-test	58,46	10,51	48,99
	p-value	0,000	0,004	0,000
MV5	**Beta**	**0,95**	**0,91**	**0,87**
	t-stat *	15,31	8,18	15,5
	R-sqr (Adj)	91,0%	74,1%	91,2%
	F-test	234,45	66,95	240,1
	p-value	0,000	0,000	0,000

* at 5% level of significance

Table 5

Average Beta estimates based on monthly returns against the Athens General Index using the twelve monthly returns prior to each year and the consequtive twelve monthly returns of the holding period

Portfolio		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Average
MV1	**Beta**	**0,53**	**0,34**	**0,51**	**0,74**	**0,63**	**0,86**	**0,49**	**0,3**	**0,24**	**0,54**	**1,9**	**1,41**	**0,71**
	t-stat *	4,32	0,33	10,81	4,17	3,19	3,82	3,52	3,17	2,47	1,51	5,07	3,87	3,85
	R-sqr (Adj)	43,4%	50,1%	83,4%	41,6%	28,6%	37,2%	33,2%	28,3%	18,1%	5,3%	51,8%	37,9%	38,2%
	F-test	18,64	24,1	116,89	17,36	10,21	14,62	12,42	10,08	6,08	2,29	25,69	15,01	22,78
	p-value	0,000	0,000	0,000	0,000	0,004	0,001	0,002	0,004	0,022	0,145	0,000	0,001	0,015
MV2	**Beta**	**0,57**	**0,63**	**0,76**	**0,58**	**1,09**	**0,97**	**0,8**	**0,51**	**0,36**	**0,6**	**1,99**	**1,39**	**0,85**
	t-stat *	4,8	7,33	10,03	4,18	6,29	4,9	4,22	4,81	4,9	2,21	5,92	4,25	5,32
	R-sqr (Adj)	48,9%	69,6%	81,3%	41,7%	62,6%	50,0%	42,2%	49,1%	50,0%	14,5%	59,7%	42,6%	51,0%
	F-test	23,05	53,72	100,68	17,48	39,55	23,99	17,79	23,16	24,03	4,9	35,05	18,04	31,79
	p-value	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,038	0,000	0,000	0,003
MV3	**Beta**	**0,62**	**0,72**	**0,92**	**0,91**	**1,05**	**0,72**	**0,97**	**0,62**	**0,55**	**0,71**	**1,93**	**1,37**	**0,92**
	t-stat *	7,1	11,54	15,66	8,97	7,33	7,02	5,59	5,61	4,88	3,19	6,48	5,35	7,39
	R-sqr (Adj)	68,2%	85,2%	91,4%	77,5%	69,6%	67,7%	56,8%	57,0%	49,8%	28,5%	64,0%	54,5%	64,2%
	F-test	50,41	133,08	245,12	80,39	53,78	49,25	31,2	31,51	23,85	10,19	41,97	28,59	64,95
	p-value	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,004	0,000	0,000	0,000
MV4	**Beta**	**0,72**	**0,91**	**0,92**	**0,8**	**1,03**	**0,98**	**0,87**	**0,74**	**0,6**	**0,7**	**1,61**	**1,17**	**0,92**

	t-stat *	10,91	16,08	15,66	8,65	7,44	8,32	6,59	8,22	8,29	4,29	5,87	6,23	8,88
	R-sqr (Adj)	83,7%	91,8%	91,4%	76,3%	70,3%	74,8%	64,9%	74,3%	74,6%	43,1%	59,3%	62,2%	72,2%
	F-test	118,94	258,7	245,12	74,87	55,37	69,19	43,47	67,64	68,68	18,44	34,51	38,78	91,14
	p-value	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
MV5	**Beta**	**1,03**	**0,86**	**0,86**	**0,88**	**0,93**	**0,81**	**0,82**	**0,87**	**0,86**	**0,92**	**1,41**	**1,01**	**0,94**
	t-stat *	25,31	22,63	13,68	13,13	11,99	5,96	9,93	22,71	16,96	13,02	11,33	13,11	14,98
	R-sqr (Adj)	96,5%	95,7%	89,0%	88,2%	86,1%	60,0%	80,9%	95,7%	92,6%	88,0%	84,7%	88,1%	87,1%
	F-test	640,81	512,05	187,16	172,45	143,74	35,47	98,56	515,76	287,79	169,63	128,36	171,81	255,30
	p-value	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

* at 5% level of significance

Table 6
Standard deviation of monthly returns

Portfolio	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Average
MV1	7,56	8,19	6,08	10,71	8,19	4,33	3,48	5,28	8,13	23,56	17,54	20,49	**10,30**
MV2	15,84	9,97	4,79	7,78	9,68	5,64	6,04	5,65	8,74	20,43	19,41	16,84	**10,90**
MV3	15,90	12,20	7,24	8,67	6,01	4,19	5,14	7,80	13,29	18,76	15,63	16,34	**10,93**
MV4	16,54	14,21	10,46	6,90	5,63	3,87	4,79	8,52	11,41	15,07	12,63	13,64	**10,31**
MV5	22,35	11,10	10,51	6,30	5,20	4,37	3,73	9,87	16,02	9,13	11,55	10,26	**10,03**

Table 7
Standard deviation of monthly returns for Bear, Flat and Bull Markets

		BEAR	FLAT	BULL	AVERAGE
Small	**MV1**	16,68	5,20	21,32	**14,40**
	MV2	16,81	4,70	16,93	**12,81**
	MV3	14,56	5,14	15,26	**11,65**
	MV4	12,02	4,96	11,74	**9,57**
Large	**MV5**	10,71	4,28	8,20	**7,73**

Table 8
Dimson AC betas for period t-24 to t

Portfolio		Lag 0	Lag 1	Lag 2	Lag 3
MV1	beta	0,73	0,75	0,85	0,93
	t-stat *	4,77	4,54	4,46	4,27
	R-sqr(adj)	45,70%	46,48%	45,83%	45,33%
	F-test	25,61	13,55	8,99	6,53
MV2	beta	0,77	0,83	0,89	0,89
	t-stat *	5,10	5,61	5,16	4,83
	R-sqr(adj)	49,30%	54,93%	52,11%	53,00%
	F-test	28,90	23,45	13,53	10,13

MV3	beta	0,83	0,89	0,97	1,02
	t-stat *	6,55	6,45	6,06	5,66
	R-sqr(adj)	58,80%	58,76%	59,28%	58,53%
	F-test	20,24	27,41	17,27	12,14
MV4	beta	0,87	0,93	1,02	1,00
	t-stat *	8,99	8,62	8,27	8,74
	R-sqr(adj)	71,3%	71,58%	70,65%	71,40%
	F-test	96,30	48,32	31,04	34,98
MV5	beta	0,91	0,97	1,03	1,01
	t-stat *	14,76	14,16	13,54	13,10
	R-sqr(adj)	86,60%	86,77%	86,59%	88,74%
	F-test	234,99	118,57	75,29	55,37

Dimson AC betas for period t-12 to t+12

Portfolio		**Lag 0**	**Lag 1**	**Lag 2**	**Lag 3**
MV1	beta	0,71	0,74	0,85	0,90
	t-stat *	3,85	3,22	3,19	3,01
	R-sqr(adj)	38,20%	35,11%	37,56%	30,86%
	F-test	22,78	7,53	5,22	3,54
MV2	beta	0,85	0,86	0,89	0,95

	t-stat *	5,32	5,23	4,65	4,40
	R-sqr(adj)	51,00%	52,36%	50,25%	50,53%
	F-test	31,79	18,65	9,89	8,02
MV3	beta	0,92	1,01	1,06	1,15
	t-stat *	7,39	7,15	6,54	6,22
	R-sqr(adj)	64,20%	65,05%	64,43%	65,74%
	F-test	64,95	32,60	19,32	14,02
MV4	beta	0,92	0,97	1,06	1,12
	t-stat *	8,88	8,55	8,33	8,04
	R-sqr(adj)	72,20%	72,13%	72,99%	74,32%
	F-test	91,14%	45,85	29,86	22,13
MV5	beta	0,94	0,91	1,01	1,03
	t-stat *	14,98	12,35	13,41	12,87
	R-sqr(adj)	87,10%	86,35%	85,33%	86,68%
	F-test	255,30	130,29	78,78	57,21

5. Summary and Conclusions

This study provides evidence that the small firm effect that was found by many researchers in the past is still strong on the Athens Stock Exchange. This constitutes a violation of CAPM since systematic risk is not the only factor that is rewarded in the market.

Estimated betas have failed to explain the risk-return relationship for the most important time period in the history of both the Greek economy and Athens Stock Exchange. Even after using Dimson's methodology, which takes into account thin trading, systematic risk was not the only priced factor in the Greek Stock Market. The use of standard deviation as a measure of total risk offers a possible explanation for the higher returns of small firms since the return premium can by partially a compensation for the higher volatility involved.

The fact that small size effect is present in different market conditions and in all periods that cover the transition of the Athens Stock Exchange from an emerging to a developed status increases the robustness of the results. However, the small firm effect may reflect other factors such as neglect, liquidity premiums and compensation for an increased default risk.

References

Ahimud, Y. and Mendelson, H. (1986) Asset Pricing and the Bid-Ask Spread, Journal of Financial Economics, 17, 223-249

Ahimud, Y. and Mendelson, H. (1991), Liquidity, Asset Prices and Financial Policy, Financial Analyst Journal, November/December, 55-66

Banz, R.W. (1981) The relationship between return and market value of common stocks, Journal of Financial Economics, March, 3-18

Bauman, S., Conover, M. and Miller, R. (1998), Growth versus Value and Large-Cap versus Small-Cap Stocks in International Markets, Financial Analyst Journal, vol.54, no.2, 75-89

Bernstein, R. (1995) Style Investing, John Wiley & Sons

Brooks, J. (1999) Does Goliath Finally Have David's Number?, Working Paper, Institute for Fiduciary Education, October

Carvell, S. and Strebel, P.J. (1987) Is there a neglected firm effect? Journal of Business, Finance and Accounting, 14, 279-290

Corhay, A., Hawawini, G. and Michel, P. (1987) Seasonality in the risk-return relationship: some international evidence. Journal of Finance 42, 49-68

Crombez, J. And Vennet, R.V. (1997) Risk/return relationship conditional on market movements ont he Brussels Stock Exchange, Working Paper, Department of Financial Economics, University of Ghent

Davis, J. and Desai, A. (1998) Stock Returns, Beta and Firm Size: The case of Bull, Bear and Flat Markets, Working Paper, Department of Finance, Kansas State University

Dimson, E. (1979) Risk Measurement When Shares are subject to Infrequent Trading, Journal of Financial Economics, 5, 197-226

Elfakhani, S. and Zaher, T. (1998) Differential Information Hypothesis, Firm Neglect and the Small Firm Size Effect, Journal of Financial and Strategic Decisions, Vol.11, No.2, 29-40

Fama, E.F. and French, K.R. (1992) The Cross-Section of expected stock returns, Journal of Finance, 47, 427-465

Fama, E.F. and French, K.R. (1996) The CAPM is Wanted, Dead or Alive. Journal of Finance, 51, 1947-1958

Fisher, J. (1966) Some New Stock Market Indices, Journal of Business, January, 191-225

Fowler, D.J., Rorke, C.H. and Jog, V.M. (1979) Heteroscedasticity, R^2 and Thin trading on the Toronto Stock Exchange, Journal of Finance, XXXIV, 5, 1209

Glezakos, M. (1994) The Market Capitalization Value as a Risk Factor in the Athens Stock Exchange, Spoudai, Vol. 43, No.1, University of Piraeus

Gooding, A. (1978) Perceived risk and capital asset pricing. Journal of Finance, 33, 1401-21

Grundy, K. and Malkiel, B. (1996) Reports of Beta's Death Have Been Greatly Exaggerated, Journal of Portfolio Management, 22, 36-44

Handa, P., Kothari, S. and Wasley, C. (1989) The Relation between return interval and betas: implications for the size effect, Journal of Financial Economics, 23, 79-100

Horowitz, J., Loughran, T. and Savin (1998) Asset pricing: Does firm size really matter? Working Paper, University of Iowa Jagannathan, R., and Wang, Z. (1993) The CAPM is alive and well. Research Department Staff Report 165. Federal Reserve Bank of Minneapolis

Ibbotson, R. and Brinson, G. (1987) Investment Markets, New York, McGraw-Hill

Ibbotson Associates (1992) Stocks, bonds, bills, and inflation-1992 Yearbook. Chicago, Ibbotson Associates

Keim, D. (1983) Size Related Anomalies and Stock Return Seasonality: Further Empirical Evidence, Journal of Financial Economics, Vol.12, No. 1, 13-32

Knez, P. and Ready, M. (1997) On the Robustness of Size and Book to Market in Cross Sectional Regression, Journal of Finance, Vol. 52, 1355-1382

Kothari, S., Shanken, J. and Sloan, R. (1995) Another look at the cross-section of expected stock returns, Journal of Finance, 50, 185-224

Leledakis, G., Davidson, I., and Karathanassis, G. (2001) The Determinants of the Cross-Section of Stock Returns in the Athens Stock Exchange. Working Paper, Warwick Business School

Levis, M. (1985) Are small firms big performers? , The Investment Analyst, 76, 21-27

Levis, M. (2000), The Record on Small Companies: A Review of the Evidence, Working Paper, City University Business School

Levis, M. and Kalliontzi, N. (1993) The predictability of the size effect, Working Paper, City University Business School

Levis, M. and Steliaros, M. (1999) The relative performance of European small cap stocks, Working paper, City University Business School

Lintner, J. (1965) The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets, Review of Economics and Statistics, February, 13-37

Loeb,T.F. (1991) Is there a gift from small-stock investing? Financial Analysts Journal, 47, January-February, 39-44

Lofthouse, S. (1994) Equity Investment Management: How to select stocks and markets, West Sussex : John Wiley & Sons

Mayers, D. (1972) Nonmarketable assets and capital market equilibrium under uncertainty. In: Studies in the theory of capital markets, ed. Michael Jensen, pp.223-248. New York: Praeger

Rathinasamy, R.S. and Mantripragada, K. (1996) The January Size Effect Revisited: Is it a case of risk mismeasurement?, Journal of Financial and Strategic Decisions, Vol.9, No.3, 9-14

Reinganum, M. (1992) A revival of the small firm effect. Journal of Portfolio Management, 18, Spring, 55-62

Rogalski, R. and Tinic, S. (1986) The January Size Effect : Anomaly or Risk Measurement?, Financial Analyst Journal, Vol.42, No.6, 63-70

Roll, R. (1977) A critique of the asset pricing theory's tests; Part I: on past and potential testability of the theory. Journal of Financial Economics, 4, 129-176

Roll, R. (1978) Ambiguity when performance is measured by the securities market line. Journal of Finance, 33, 1051-1059

Siegel, J. (1994) Stock for the long-run. Chicago: Richard D. Irwin

Sharpe, W.F. (1964) Capital asset prices: a theory of market equilibrium under conditions of risk. Journal of Finance, 19, 425-42

Speidell, L. and Graves, J. (1998) The case for international small-cap stocks, Journal of Investing, Winter, 6-10

Stoll, H.R. and Whaley, R.E. (1983) Trnasaction costs and the small firm effect. Journal of Financial Economics, 12, 57-79